Configuring X.25 Gateway Services

BayRS Version 13.00
Site Manager Software Version 7.00

Part No. 303546-A Rev 00
October 1998

Bay Networks *Where Information Flows.*™

4401 Great America Parkway
Santa Clara, CA 95054

8 Federal Street
Billerica, MA 01821

Copyright © 1998 Bay Networks, Inc.

All rights reserved. Printed in the USA. October 1998.

The information in this document is subject to change without notice. The statements, configurations, technical data, and recommendations in this document are believed to be accurate and reliable, but are presented without express or implied warranty. Users must take full responsibility for their applications of any products specified in this document. The information in this document is proprietary to Bay Networks, Inc.

The software described in this document is furnished under a license agreement and may only be used in accordance with the terms of that license. A summary of the Software License is included in this document.

Trademarks

ACE, AFN, AN, BCN, BLN, BN, BNX, CN, FRE, LN, Optivity, PPX, Quick2Config, and Bay Networks are registered trademarks and Advanced Remote Node, ANH, ARN, ASN, BayRS, BaySecure, BayStack, BayStream, BCC, BCNX, BLNX, EZ Install, EZ Internetwork, EZ LAN, FN, IP AutoLearn, PathMan, RouterMan, SN, SPEX, Switch Node, System 5000, and the Bay Networks logo are trademarks of Bay Networks, Inc.

Microsoft, MS, MS-DOS, Win32, Windows, and Windows NT are registered trademarks of Microsoft Corporation.

All other trademarks and registered trademarks are the property of their respective owners.

Restricted Rights Legend

Use, duplication, or disclosure by the United States Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

Notwithstanding any other license agreement that may pertain to, or accompany the delivery of, this computer software, the rights of the United States Government regarding its use, reproduction, and disclosure are as set forth in the Commercial Computer Software-Restricted Rights clause at FAR 52.227-19.

Statement of Conditions

In the interest of improving internal design, operational function, and/or reliability, Bay Networks, Inc. reserves the right to make changes to the products described in this document without notice.

Bay Networks, Inc. does not assume any liability that may occur due to the use or application of the product(s) or circuit layout(s) described herein.

Portions of the code in this software product may be Copyright © 1988, Regents of the University of California. All rights reserved. Redistribution and use in source and binary forms of such portions are permitted, provided that the above copyright notice and this paragraph are duplicated in all such forms and that any documentation, advertising materials, and other materials related to such distribution and use acknowledge that such portions of the software were developed by the University of California, Berkeley. The name of the University may not be used to endorse or promote products derived from such portions of the software without specific prior written permission.

SUCH PORTIONS OF THE SOFTWARE ARE PROVIDED “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

In addition, the program and information contained herein are licensed only pursuant to a license agreement that contains restrictions on use and disclosure (that may incorporate by reference certain limitations and notices imposed by third parties).

Bay Networks, Inc. Software License Agreement

NOTICE: Please carefully read this license agreement before copying or using the accompanying software or installing the hardware unit with pre-enabled software (each of which is referred to as "Software" in this Agreement). BY COPYING OR USING THE SOFTWARE, YOU ACCEPT ALL OF THE TERMS AND CONDITIONS OF THIS LICENSE AGREEMENT. THE TERMS EXPRESSED IN THIS AGREEMENT ARE THE ONLY TERMS UNDER WHICH BAY NETWORKS WILL PERMIT YOU TO USE THE SOFTWARE. If you do not accept these terms and conditions, return the product, unused and in the original shipping container, within 30 days of purchase to obtain a credit for the full purchase price.

1. License Grant. Bay Networks, Inc. ("Bay Networks") grants the end user of the Software ("Licensee") a personal, nonexclusive, nontransferable license: a) to use the Software either on a single computer or, if applicable, on a single authorized device identified by host ID, for which it was originally acquired; b) to copy the Software solely for backup purposes in support of authorized use of the Software; and c) to use and copy the associated user manual solely in support of authorized use of the Software by Licensee. This license applies to the Software only and does not extend to Bay Networks Agent software or other Bay Networks software products. Bay Networks Agent software or other Bay Networks software products are licensed for use under the terms of the applicable Bay Networks, Inc. Software License Agreement that accompanies such software and upon payment by the end user of the applicable license fees for such software.

2. Restrictions on use; reservation of rights. The Software and user manuals are protected under copyright laws. Bay Networks and/or its licensors retain all title and ownership in both the Software and user manuals, including any revisions made by Bay Networks or its licensors. The copyright notice must be reproduced and included with any copy of any portion of the Software or user manuals. Licensee may not modify, translate, decompile, disassemble, use for any competitive analysis, reverse engineer, distribute, or create derivative works from the Software or user manuals or any copy, in whole or in part. Except as expressly provided in this Agreement, Licensee may not copy or transfer the Software or user manuals, in whole or in part. The Software and user manuals embody Bay Networks' and its licensors' confidential and proprietary intellectual property. Licensee shall not sublicense, assign, or otherwise disclose to any third party the Software, or any information about the operation, design, performance, or implementation of the Software and user manuals that is confidential to Bay Networks and its licensors; however, Licensee may grant permission to its consultants, subcontractors, and agents to use the Software at Licensee's facility, provided they have agreed to use the Software only in accordance with the terms of this license.

3. Limited warranty. Bay Networks warrants each item of Software, as delivered by Bay Networks and properly installed and operated on Bay Networks hardware or other equipment it is originally licensed for, to function substantially as described in its accompanying user manual during its warranty period, which begins on the date Software is first shipped to Licensee. If any item of Software fails to so function during its warranty period, as the sole remedy Bay Networks will at its discretion provide a suitable fix, patch, or workaround for the problem that may be included in a future Software release. Bay Networks further warrants to Licensee that the media on which the Software is provided will be free from defects in materials and workmanship under normal use for a period of 90 days from the date Software is first shipped to Licensee. Bay Networks will replace defective media at no charge if it is returned to Bay Networks during the warranty period along with proof of the date of shipment. This warranty does not apply if the media has been damaged as a result of accident, misuse, or abuse. The Licensee assumes all responsibility for selection of the Software to achieve Licensee's intended results and for the installation, use, and results obtained from the Software. Bay Networks does not warrant a) that the functions contained in the software will meet the Licensee's requirements, b) that the Software will operate in the hardware or software combinations that the Licensee may select, c) that the operation of the Software will be uninterrupted or error free, or d) that all defects in the operation of the Software will be corrected. Bay Networks is not obligated to remedy any Software defect that cannot be reproduced with the latest Software release. These warranties do not apply to the Software if it has been (i) altered, except by Bay Networks or in accordance with its instructions; (ii) used in conjunction with another vendor's product, resulting in the defect; or (iii) damaged by improper environment, abuse, misuse, accident, or negligence. THE FOREGOING WARRANTIES AND LIMITATIONS ARE EXCLUSIVE REMEDIES AND ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Licensee is responsible for the security of

its own data and information and for maintaining adequate procedures apart from the Software to reconstruct lost or altered files, data, or programs.

4. Limitation of liability. IN NO EVENT WILL BAY NETWORKS OR ITS LICENSORS BE LIABLE FOR ANY COST OF SUBSTITUTE PROCUREMENT; SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES; OR ANY DAMAGES RESULTING FROM INACCURATE OR LOST DATA OR LOSS OF USE OR PROFITS ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OF THE SOFTWARE, EVEN IF BAY NETWORKS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL THE LIABILITY OF BAY NETWORKS RELATING TO THE SOFTWARE OR THIS AGREEMENT EXCEED THE PRICE PAID TO BAY NETWORKS FOR THE SOFTWARE LICENSE.

5. Government Licensees. This provision applies to all Software and documentation acquired directly or indirectly by or on behalf of the United States Government. The Software and documentation are commercial products, licensed on the open market at market prices, and were developed entirely at private expense and without the use of any U.S. Government funds. The license to the U.S. Government is granted only with restricted rights, and use, duplication, or disclosure by the U.S. Government is subject to the restrictions set forth in subparagraph (c)(1) of the Commercial Computer Software—Restricted Rights clause of FAR 52.227-19 and the limitations set out in this license for civilian agencies, and subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause of DFARS 252.227-7013, for agencies of the Department of Defense or their successors, whichever is applicable.

6. Use of Software in the European Community. This provision applies to all Software acquired for use within the European Community. If Licensee uses the Software within a country in the European Community, the Software Directive enacted by the Council of European Communities Directive dated 14 May, 1991, will apply to the examination of the Software to facilitate interoperability. Licensee agrees to notify Bay Networks of any such intended examination of the Software and may procure support and assistance from Bay Networks.

7. Term and termination. This license is effective until terminated; however, all of the restrictions with respect to Bay Networks' copyright in the Software and user manuals will cease being effective at the date of expiration of the Bay Networks copyright; those restrictions relating to use and disclosure of Bay Networks' confidential information shall continue in effect. Licensee may terminate this license at any time. The license will automatically terminate if Licensee fails to comply with any of the terms and conditions of the license. Upon termination for any reason, Licensee will immediately destroy or return to Bay Networks the Software, user manuals, and all copies. Bay Networks is not liable to Licensee for damages in any form solely by reason of the termination of this license.

8. Export and Re-export. Licensee agrees not to export, directly or indirectly, the Software or related technical data or information without first obtaining any required export licenses or other governmental approvals. Without limiting the foregoing, Licensee, on behalf of itself and its subsidiaries and affiliates, agrees that it will not, without first obtaining all export licenses and approvals required by the U.S. Government: (i) export, re-export, transfer, or divert any such Software or technical data, or any direct product thereof, to any country to which such exports or re-exports are restricted or embargoed under United States export control laws and regulations, or to any national or resident of such restricted or embargoed countries; or (ii) provide the Software or related technical data or information to any military end user or for any military end use, including the design, development, or production of any chemical, nuclear, or biological weapons.

9. General. If any provision of this Agreement is held to be invalid or unenforceable by a court of competent jurisdiction, the remainder of the provisions of this Agreement shall remain in full force and effect. This Agreement will be governed by the laws of the state of California.

Should you have any questions concerning this Agreement, contact Bay Networks, Inc., 4401 Great America Parkway, P.O. Box 58185, Santa Clara, California 95054-8185.

LICENSEE ACKNOWLEDGES THAT LICENSEE HAS READ THIS AGREEMENT, UNDERSTANDS IT, AND AGREES TO BE BOUND BY ITS TERMS AND CONDITIONS. LICENSEE FURTHER AGREES THAT THIS AGREEMENT IS THE ENTIRE AND EXCLUSIVE AGREEMENT BETWEEN BAY NETWORKS AND LICENSEE, WHICH SUPERSEDES ALL PRIOR ORAL AND WRITTEN AGREEMENTS AND COMMUNICATIONS BETWEEN THE PARTIES PERTAINING TO THE SUBJECT MATTER OF THIS AGREEMENT. NO DIFFERENT OR ADDITIONAL TERMS WILL BE ENFORCEABLE AGAINST BAY NETWORKS UNLESS BAY NETWORKS GIVES ITS EXPRESS WRITTEN CONSENT, INCLUDING AN EXPRESS WAIVER OF THE TERMS OF THIS AGREEMENT.

Contents

Preface

Before You Begin ix
Text Conventions x
Acronyms xi
Bay Networks Technical Publications xii
How to Get Help xii

Chapter 1
X.25 Gateway Overview

X.25 Gateway Topology 1-2
Network Interfaces 1-3
X.25 Level 3 (PLP) Interface 1-3
X.25 Level 2 (LAPB-Only) Interface 1-3
TCP Interface 1-4
What X.25 Gateway Does 1-4
Protocol Translation 1-4
Establishing Connections from the X.25 Equipment 1-6
SVCs With a Called X.121 Address 1-6
SVCs Without a Called X.121 Address 1-7
Permanent Virtual Circuits (PVCs) 1-7
Establishing Connections from the X.25 Level 2 (LAPB) Terminal 1-8
Establishing Connections During Failure Conditions for PVC/TCP Translation 1-8
Reestablishing the X.25 Connection 1-8
Reestablishing the TCP/IP Connection 1-9
Establishing Connections from the TCP/IP Host 1-9
Connection Summary 1-11

Handling Large Data Messages 1-12
How X.25 Handles Large Data Messages 1-12
How TCP Handles Large Data Messages 1-12
X.25 Gateway Message Block Options 1-13

Chapter 2
Enabling X.25 Gateway

Preparing a Configuration File 2-1
Configuring X.25 IPEX Services 2-1
Enabling X.25 Gateway Services 2-2
Adding an Entry to the IPEX Mapping Table 2-2
Configuring Mapping Parameters 2-7
IPEX Mapping Parameters Windows 2-7
Parameters for PVC and SVC Connections 2-9
Parameters for TCP Connections 2-11
Replicating a Configuration 2-12
Parameters for Replicating Connections 2-18

Index

Figures

Figure 1-1. Sample Network Topology Using X.25 Gateway 1-2
Figure 1-2. How X.25 Gateway Establishes a Session (X.25 Initiated) 1-5
Figure 1-3. Reestablishing X.25 Connections 1-9
Figure 1-4. Reestablishing TCP/IP Connections 1-9
Figure 1-5. How X.25 Gateway Establishes a Session (TCP Initiated) 1-10
Figure 1-6. Role of the X.25 and TCP Protocol Stacks in X.25 Gateway 1-11
Figure 2-1. IPEX Mapping Add Window for Source PVC 2-4
Figure 2-2. IPEX Mapping Parameters Window for PVC 2-8
Figure 2-3. IPEX Mapping Parameters Window for SVC 2-8
Figure 2-4. IPEX Mapping Parameters Window for TCP 2-9
Figure 2-5. IPEX Mapping Table Configuration Window 2-13
Figure 2-6. IPEX Mapping Replication Window 2-15
Figure 2-7. IPEX Mapping Table Configuration Window After Replicating a PVC-to-TCP Connection 2-16
Figure 2-8. IPEX Mapping Table Configuration Window After Replicating a TCP-to-PVC Connection 2-17

Preface

This guide describes X.25 Gateway services and what you do to start and customize X.25 Gateway services on a Bay Networks® router.

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (refer to the installation manual that came with your router).
- Connect the router to the network and create a pilot configuration file (refer to *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks BayRS™ and Site Manager software. For information about upgrading BayRS and Site Manager, see the upgrading guide for your version of BayRS.

Text Conventions

This guide uses the following text conventions:

bold text	Indicates text that you need to enter and command names and options. Example: Enter **show ip** {**alerts** | **routes**} Example: Use the **dinfo** command.
italic text	Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is: **show at** <*valid_route*> *valid_route* is one variable and you substitute one value for it.
`screen text`	Indicates system output, for example, prompts and system messages. Example: `Set Bay Networks Trap Monitor Filters`
separator (>)	Shows menu paths. Example: Protocols > IP identifies the IP option on the Protocols menu.
vertical line (|)	Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command. Example: If the command syntax is: **show ip** {**alerts** | **routes**}, you enter either: **show ip alerts** or **show ip routes**, but not both.

Acronyms

CCITT	International Telegraph and Telephone Consultative Committee (now ITU-T)
DCE	data circuit-terminating equipment
DDN	Defense Data Network
DTE	data terminal equipment
FDDI	Fiber Distributed Data Interface
IP	Internet Protocol
IPEX	IP Encapsulation of X.25
ITU-T	International Telecommunications Union–Telecommunications (formerly CCITT)
LAN	local area network
LAPB	Link Access Procedure Balanced
LCN	logical channel number
MAN	metropolitan area network
MIB	Management Information Base
MCT1	Multichannel T1
MTU	maximum transmission unit
PDN	Public Data Network
PLP	Packet Layer Protocol
PPP	Point-to-Point Protocol
PToP	Point-to-Point (Bay Networks proprietary)
PVC	permanent virtual circuit
SNMP	Simple Network Management Protocol
SVC	switched virtual circuit
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
Telnet	Telecommunication Network

TFTP	Trivial File Transfer Protocol
WAN	wide area network

Bay Networks Technical Publications

You can now print Bay Networks technical manuals and release notes free, directly from the Internet. Go to *support.baynetworks.com/library/tpubs/*. Find the Bay Networks product for which you need documentation. Then locate the specific category and model or version for your hardware or software product. Using Adobe Acrobat Reader, you can open the manuals and release notes, search for the sections you need, and print them on most standard printers. You can download Acrobat Reader free from the Adobe Systems Web site, *www.adobe.com*.

You can purchase Bay Networks documentation sets, CDs, and selected technical publications through the Bay Networks Collateral Catalog. The catalog is located on the World Wide Web at *support.baynetworks.com/catalog.html* and is divided into sections arranged alphabetically:

- The “CD ROMs” section lists available CDs.
- The “Guides/Books” section lists books on technical topics.
- The “Technical Manuals” section lists available printed documentation sets.

Make a note of the part numbers and prices of the items that you want to order. Use the “Marketing Collateral Catalog description” link to place an order and to print the order form.

How to Get Help

For product assistance, support contracts, or information about educational services, go to the following URL:

http://www.baynetworks.com/corporate/contacts/

Or telephone the Bay Networks Technical Solutions Center at:

800-2LANWAN

Chapter 1
X.25 Gateway Overview

X.25 Gateway lets you send and receive messages between X.25 and Transmission Control Protocol/Internet Protocol (TCP/IP) networks. It maps TCP sockets to X.25 virtual circuits (and vice versa) or to Link Access Procedure Balanced (LAPB) point-to-point connection identifiers.

The Gateway software supports X.25 permanent virtual circuits (PVCs) and switched virtual circuits (SVCs), as well as TCP/IP over all interface types supported in the Bay Networks router.

X.25 Gateway supports:

- TCP/IP over Fiber Distributed Data Interface (FDDI), Ethernet, and token ring LAN media, or over X.25, frame relay, Asynchronous Transfer Mode (ATM), and switched multimegabit data service (SMDS), wide area network (WAN), or metropolitan area network (MAN) media
- X.25 Levels 2 and 3 over synchronous interfaces (6 MB/s and below) or Multichannel T1 (MCT1) interfaces
- 10 VCs per logical channel for the FRE2-040-32MB platform, for a total of 240VCs per slot
- 32 VCs per channel for the FRE1-060-64MB, for a total of 310VCs per slot

Use Site Manager's Configuration Manager to configure a system for X.25 Gateway services.

X.25 Gateway Topology

Figure 1-1 shows a topology consisting of two Bay Networks router systems and a TCP/IP network. The top system serves as a TCP/IP-to-X.25 gateway. The bottom system serves as a TCP/IP-to-LAPB gateway. In this example, terminals connected to X.25 networks can exchange messages with host systems on a TCP/IP network through the Bay Networks routers using the X.25 Gateway service.

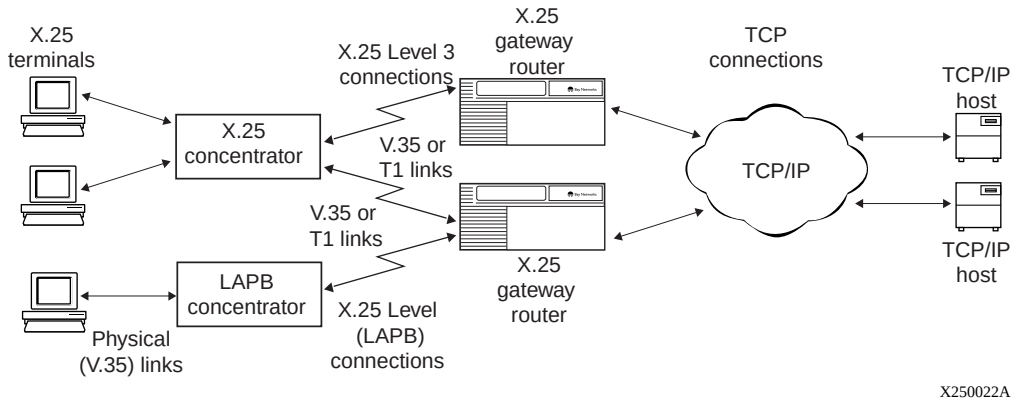

Figure 1-1. Sample Network Topology Using X.25 Gateway

The router translates data received from X.25 virtual connections into TCP data packets and forwards those packets out through TCP connections. The router also translates data received from TCP connections into X.25 data and forwards the data out through X.25 connections. You can connect the equipment to the router by a leased line, an X.25 packet-switched network, or a T1 or E1 circuit-switched network.

You can also configure the router as a TCP/IP-to-CCITT (now ITU-T) X.25 Level 2 gateway as in the bottom part of Figure 1-1. This configuration allows access from LAPB-based (X.25 Level 2) equipment with no X.25 Level 3 support. This manual refers to this feature as *LAPB-only support.*

With this configuration, the router translates data received from LAPB connections to TCP data packets and forwards those packets out through TCP connections. It also translates data received from TCP connections to LAPB data and forwards the data out through LAPB connections.

Network Interfaces

Bay Networks routers that support X.25 Gateway services use the following protocols:

- X.25 Level 3 Packet Layer Protocol (PLP)
- X.25 Level 2 Protocol (LAPB)
- Transmission Control Protocol (TCP)
- Internet Protocol (IP)

X.25 Level 3 (PLP) Interface

On an X.25 Level 3 interface, you can create and configure multiple virtual circuits, including:

- Permanent virtual circuits
- Switched virtual circuits, with or without called X.121 addresses

You can create a set of either of these connections or a combination of the two. On any X.25 interface, you can configure either X.25 Gateway service or other types of X.25 services, such as Public Data Network (PDN), Point-to-Point (PToP), and Defense Data Network (DDN). If you configure X.25 Gateway service on an X.25 interface, the software translates data sent and received between the X.25 network interface and the TCP/IP network interface. It uses X.25 flow control mechanisms to detect congestion in the X.25 connection.

X.25 Gateway uses the X.25 Level 3 client interface to:

- Open and close X.25 connections
- Send data to the X.25 module for transmission
- Process received data delivered from the X.25 module
- Control the flow of data across the client interface

X.25 Level 2 (LAPB-Only) Interface

X.25 Gateway also supports a direct LAPB interface, so terminals can transfer data in LAPB format without using the X.25 packet layer. You can select specific LAPB link circuits for the translation service to use instead of the X.25 PLP.

TCP Interface

X.25 Gateway appears to TCP as a client. As such, the software specifies one *socket* for the local TCP interface (consisting of its IP address and TCP port number) and another socket for the remote TCP interface to establish a connection. Each X.25 connection corresponds to only one TCP connection.

Since many TCP connections may be active concurrently to support many Gateway sessions, a large range of TCP port numbers creates separate sockets for individual sessions. The port numbers reserved for X.25 Gateway service are 12,304 to 16,399.

X.25 Gateway uses the TCP client interface to

- Open, close, and check the status of TCP connections.
- Send data to the TCP module for transmission.
- Process received data delivered from the TCP module.
- Control the flow of data across the client interface.

What X.25 Gateway Does

X.25 Gateway consists of a source circuit and a destination circuit. The gateway receives the first incoming connection on the *source circuit*, and attempts to establish an outgoing connection on the *destination circuit*. In Figure 1-2, the source circuit is the one with the X.25 connection.

Protocol Translation

Figure 1-2 shows the sequence of establishing the translation session when the connection request comes from the X.25 terminal.

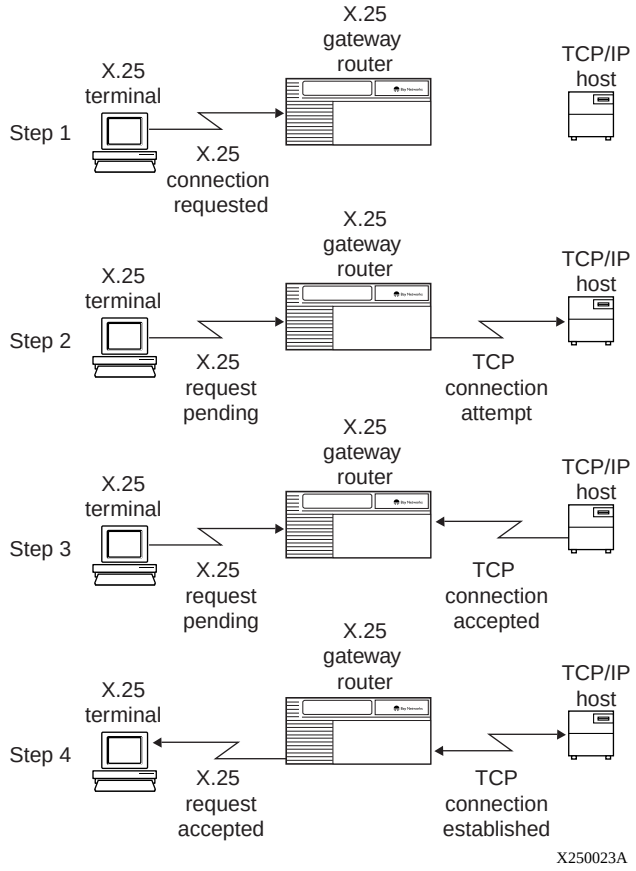

Figure 1-2. How X.25 Gateway Establishes a Session (X.25 Initiated)

If the router detects congestion on the receiving side of the network, it controls the data flow by queuing the requests on the sending side until the congestion lifts or the connection terminates.

Establishing Connections from the X.25 Equipment

Either the X.25 equipment or the TCP/IP-based system can request a connection. The software relies on a set of configured *mapping* parameters to associate the X.25 connection on one side of the router to the TCP connection on the other side.

In response to a connection request from the X.25 equipment, the router establishes a connection to a TCP/IP server. When this TCP connection is established, the router accepts the X.25 connection attempt. This one-to-one connection mapping creates a consistent and reliable Gateway session.

The types of X.25 connections that X.25 Gateway supports include:

- Switched virtual circuits (SVCs)
- Switched virtual circuits with no X.121 called address
- Permanent virtual circuits (PVCs)

With an X.25 Level 3 interface, you can establish a switched virtual circuit or a permanent virtual circuit between the X.25 equipment and the TCP-based system. An SVC is a temporary logical connection. It may or may not have a “called address” associated with it (depending on whether the type of connection that you configured required an X.121 called address). The following sections describe what you configure for each of these connections.

SVCs With a Called X.121 Address

To establish an SVC connection that contains a specified X.25 called address (X.121 address), you configure mapping information that X.25 Gateway uses to set a path for forwarding data traffic received on an X.25 SVC to a specific remote TCP/IP peer. The remote TCP/IP peer has an IP address and TCP port number that correspond to the X.25 called address. This correspondence is the mapping information that you must configure for X.25-to-TCP conversion. The mapping information consists of:

- The point of attachment (that is, the circuit interface) on the Gateway system at which the SVC establishes the connection
- The X.25 called address of the incoming connection
- The associated remote TCP socket (IP address and TCP port number) that identifies the remote end of the TCP connection

SVCs Without a Called X.121 Address

When the X.25 SVC connection does not contain an X.121 called address in the incoming call request packet, you specify the SVC service on that circuit to be a "special" SVC service interface by configuring:

- The circuit interface in X.25 Gateway at which the SVC establishes the connection
- The SVC service interface on that circuit, which is "special" in that it must be set up as a data terminal equipment (DTE) interface, instead of as a data circuit-terminating equipment (DCE) interface
- The associated remote TCP socket (remote IP address and TCP port number) that identifies the remote end of the TCP connection

The router uses this information to form a translation session by accepting this connection and establishing an associated TCP connection.

Permanent Virtual Circuits (PVCs)

For each permanent virtual circuit connection between the X.25 system and X.25 Gateway, there is a corresponding TCP connection set up between X.25 Gateway and the TCP/IP peer. This connection remains established until either:

- The X.25 equipment resets the PVC connection.
- The X.25 interface is restarted.
- The TCP peer terminates the TCP connection.

The mapping information that you must configure is:

- The circuit interface for the PVC connection
- The logical channel number (LCN) of the PVC connection
- The associated remote TCP socket (IP address and TCP port number) that identifies the remote end of the TCP connection

Establishing Connections from the X.25 Level 2 (LAPB) Terminal

The router uses a similar procedure for establishing LAPB-to-TCP connections. You must specify the mapping information needed to configure the connection, specifically:

- The circuit interface through which X.25 Gateway will establish a LAPB connection
- Its associated remote TCP socket, which identifies the remote end of the TCP connection

This mapping information sets up the path for forwarding data traffic received in a LAPB circuit to a specific remote TCP/IP server and for forwarding data traffic received from a TCP connection to a specific LAPB circuit.

When it has established this LAPB-to-TCP translation session, X.25 Gateway translates the LAPB information frames it receives from the LAPB terminals into TCP data segments, and vice versa.

Establishing Connections During Failure Conditions for PVC/TCP Translation

The X.25 Gateway software running on X.25 PVC devices is able to reestablish a connection when a fault occurs at the TCP/IP or X.25 physical layer. You do not have to enable or configure this feature. The figures below show how the software reestablishes a connection between X.25 and TCP/IP.

Reestablishing the X.25 Connection

When a physical layer fault occurs (a disconnected cable) at the X.25 interface (Figure 1-3), X.25 Gateway disconnects the associated TCP connections. It reestablishes the TCP connections to the mapped X.25 virtual circuits when the X.25 interface is again available.

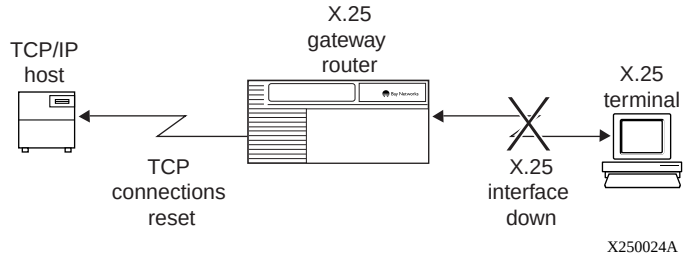

Figure 1-3. Reestablishing X.25 Connections

Reestablishing the TCP/IP Connection

In the event of a physical layer fault on the TCP/IP interface (Figure 1-4), X.25 Gateway resets any established TCP connections as well as the X.25 connections associated with each TCP connection. The software attempts to reestablish a TCP connection until the TCP interface is again available. When TCP connections are available, the software resets the X.25 connections to an operational state.

Examples of physical layer faults include a disconnected cable or a failure at either the X.25 Gateway or remote TCP/IP host interface.

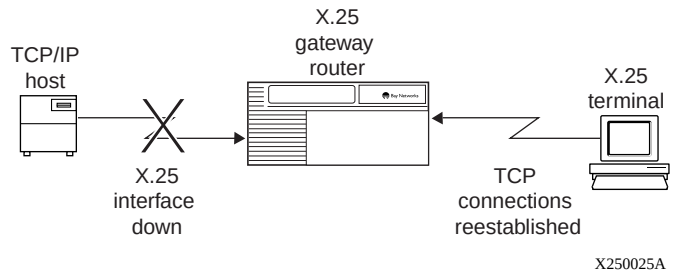

Figure 1-4. Reestablishing TCP/IP Connections

Establishing Connections from the TCP/IP Host

When a TCP/IP-based system issues a connection request, X.25 Gateway performs the sequence of actions shown in Figure 1-5.

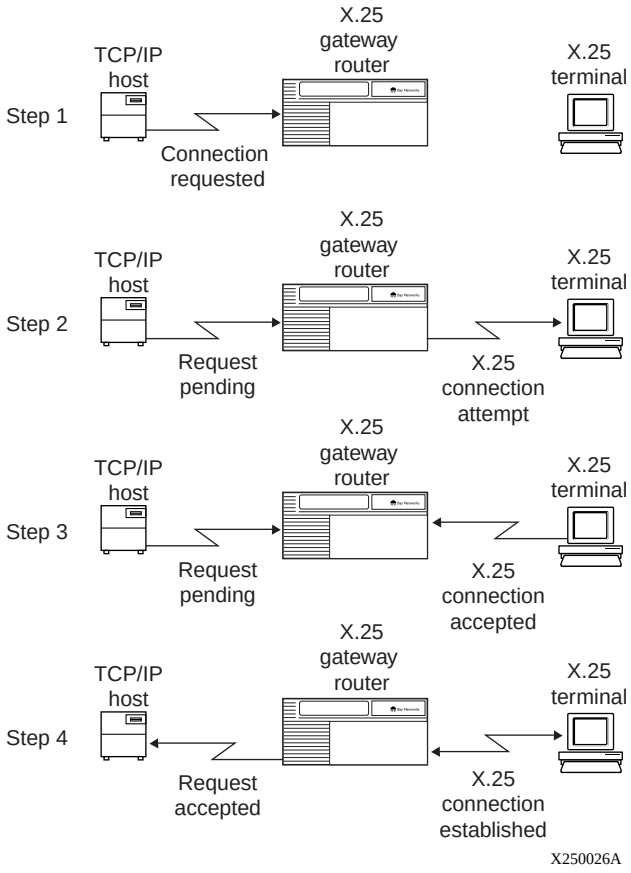

Figure 1-5. How X.25 Gateway Establishes a Session (TCP Initiated)

After establishing the X.25 connection, X.25 Gateway accepts the TCP connection. This one-to-one connection mapping provides another consistent and reliable session. The mapping information you need to configure is:

- The circuit interface on which X.25 Gateway establishes the TCP connection
- The TCP port number that uniquely identifies the translation session
- The type of connection, SVC or PVC, at the X.25 end of the connection
- The logical channel number (LCN) of the PVC connection, or the pair of calling and called X.121 addresses of the SVC connection

After establishing this X.25-to-TCP session, X.25 Gateway translates X.25 Level 3 data packets received from the X.25 client terminals to TCP data segments, and vice versa.

Connection Summary

To set up a reliable X.25 Gateway session, both sides must successfully establish the connections. When one side receives a connection indication, the other side initiates a connection attempt. If the connection attempt fails on the far side, the near side rejects the connection request it received.

Figure 1-6 shows how X.25 Gateway mediates the interaction between the two protocol stacks as the data flows between the X.25 client terminals and the TCP-based hosts.

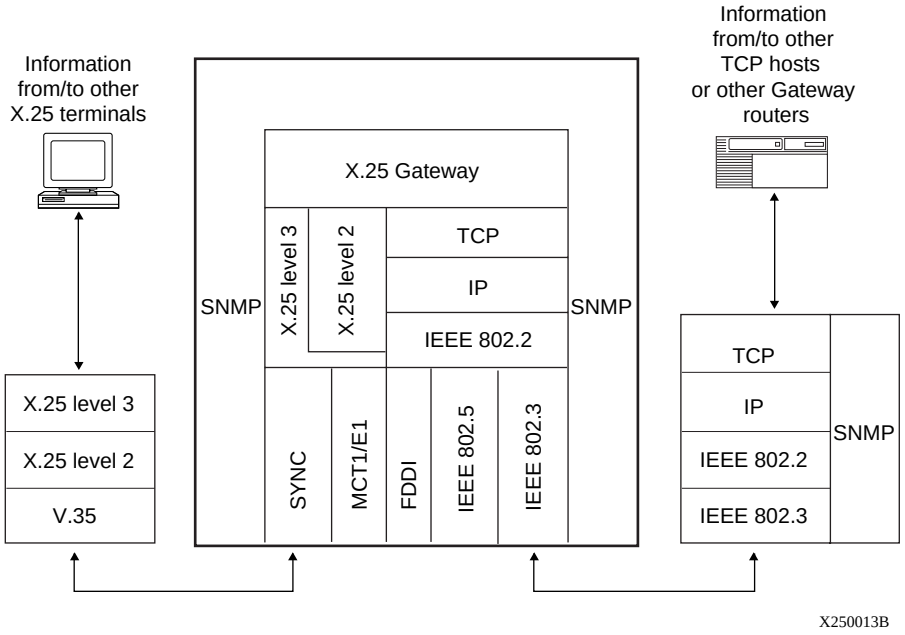

Figure 1-6. Role of the X.25 and TCP Protocol Stacks in X.25 Gateway

The TCP and X.25 communication stacks share the responsibility for maintaining reliable and efficient data flow. If data loss occurs on one side, that side retransmits the lost data. In addition, both sides independently maintain protocol flow control.

Data loss may result from either software or hardware errors, or catastrophic failures. Redundancy in network design is critical for handling these types of data communication failures.

Handling Large Data Messages

X.25 is a message-based protocol, and TCP is an unstructured stream protocol. They differ in the way they send outgoing traffic and deliver incoming traffic to their clients.

How X.25 Handles Large Data Messages

When the X.25 client submits an X.25 message that is larger than an X.25 packet size, the X.25 protocol fragments the message. X.25 then transmits the sequence of packets containing these fragments. Within each packet, X.25 includes a flag that indicates the fragmentation and aids in the reassembly process at the receiving end.

How TCP Handles Large Data Messages

TCP, on the other hand, does not have a flag to mark fragmentation of messages that are larger than the TCP maximum transmission unit (MTU) size. The portion that does not fit into one TCP data segment is sent in a subsequent data segment. Without the flag and any indication of the size of the message, the TCP client has no way of determining the boundary of a message; that is, whether the complete message is contained within one or in several data segments. When X.25 Gateway receives the X.25 user data and translates it to a TCP data segment, the message boundary is lost.

To minimize changes in the existing host applications, X.25 Gateway maintains the X.25 message boundary. It structures the application information into message blocks before encapsulating it in TCP data segments. Each message block contains a header and a data portion.

X.25 Gateway Message Block Options

You can configure X.25 Gateway with the following message block options.

- No message block structure in any TCP segment -- X.25 Gateway translates each TCP data segment as a complete message.
- Message length specified -- The header portion of the message contains a 2-byte message length field. The data portion holds the actual application information. The length field indicates the total length of the application data portion in the message block.
- Message version, type, and length specified in the header -- The header specifies the version of the message header format, including a More flag bit. The Type field specifies the message type, DATA. The data portion holds the actual application information.

The message block options that let you specify the message length allow TCP clients to determine message boundaries. Depending on the size of the message block, a TCP data segment can contain multiple message blocks. A larger message block may be transmitted in several TCP data segments. With the 2-byte length field, the maximum length of a message block that X.25 Gateway can send and receive using TCP is 64 KB.

Note: While the maximum length of the X.25 message that X.25 Gateway can send to the terminal is 64 KB, the maximum length of the X.25 message that X.25 Gateway can receive from the terminal is 4 KB.

Chapter 2
Enabling X.25 Gateway

This chapter, as outlined in the following table, describes how to use the Configuration Manager to set up X.25 Gateway services.

Section	Page
Preparing a Configuration File	2-1
Configuring X.25 IPEX Services	2-1
Enabling X.25 Gateway Services	2-2
Adding an Entry to the IPEX Mapping Table	2-2
Complete the following steps to configure IPEX mapping parameters:	2-7

Preparing a Configuration File

Before you configure X.25 Gateway:

1. Create and save a configuration file that has at least one WAN interface.
2. Retrieve the configuration file in local, remote, or dynamic mode.
3. Specify router hardware if this is a local-mode configuration file.

Refer to *Configuring and Managing Routers with Site Manager* for instructions.

Configuring X.25 IPEX Services

When you enable X.25 Gateway services, you must configure X.25 IPEX services. Refer to Chapters 3 and 4 of *Configuring X.25 Services* for instructions on enabling X.25 and editing X.25 parameters. Refer to Chapter 5 of that guide for instructions on configuring IPEX.

Enabling X.25 Gateway Services

To enable X.25 Gateway services:

1. Add an entry to the IPEX mapping table.
2. Choose Gateway as the IPEX Mapping Type.
3. Configure mapping parameters.

Use the following instructions to add an IPEX mapping entry and choose Gateway as the mapping type.

Adding an Entry to the IPEX Mapping Table

Complete the following steps to add an entry to the IPEX mapping table:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, select **Circuits > Edit Circuits.**	The Circuit List window opens.
2. Choose an X.25 interface, then click on **Edit**.	The Circuit Definition window opens.
3. Choose **X25 Protocol > Service**.	The X.25 Service Configuration window appears. It lists all currently defined network service records.
4. Choose the network service record you want to configure for X.25 Gateway services.	
5. Click on **Add**.	The X.25 Service window opens.
6. Position your cursor in the **Type** parameter bar, click on the **Values** button, and choose **IPEX** as the service type.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
7. Edit the following parameters as appropriate to your network. Use **Help** or see the parameter descriptions in *Configuring X.25 Services.* • **First PVC LCN** • **Number of PVC LCN** • **Service VC Type** • **Window Size** • **Packet Size**	
8. Click on **OK**.	The IPEX Mapping Table Configuration window opens.
9. Click on **Add**.	The IPEX Mapping Add window opens (Figure 2-1).
10. Set the following parameters. Click on **Help** or see the parameter descriptions beginning on page 2-4. • **Source Connection Type** • **Mapping Type** • **TCP Circuit Name** • **TCP Header Type**	

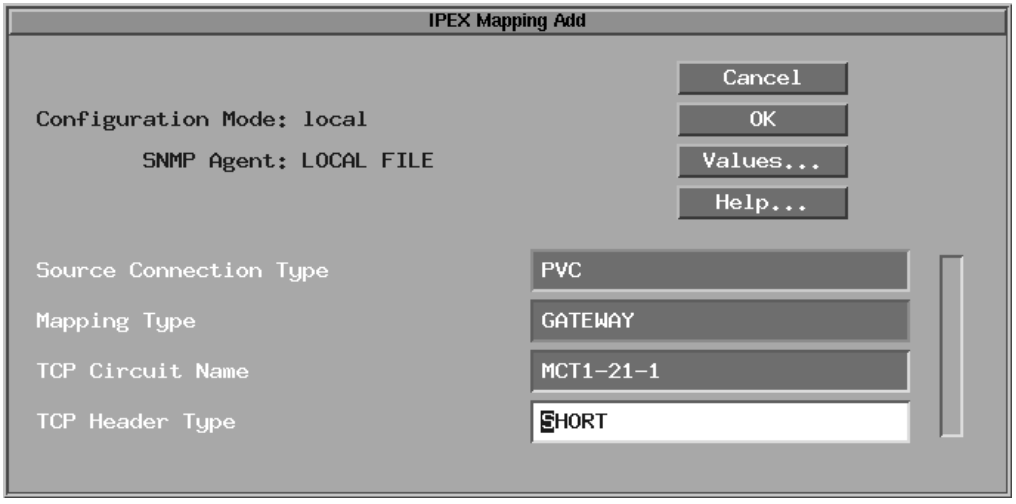

Figure 2-1. IPEX Mapping Add Window for Source PVC

Note: This window is the same for PVC, SVC, and TCP source connections. The Mapping Type is always Gateway. Values for the other parameters are specific to your network.

Parameter: Source Connection Type

Default: None

Options: PVC | SVC | TCP

Function: Specifies the type of connection at the sending end of the original message. PVC and SVC specify an X.25 Level 3 connection, either a permanent virtual circuit or a switched virtual circuit. TCP is a Transmission Control Protocol connection.

Source connection types PVC and SVC send to destination connection type TCP. Source connection type TCP sends to destination connection type PVC or SVC.

Instructions: Select PVC to specify an X.25 connection to a permanent virtual circuit. Select SVC to specify an X.25 connection to a switched virtual circuit. Select TCP to specify a Transmission Control Protocol connection.

MIB Object ID: 1.3.6.1.4.18.3.5.15.2.1.4

Parameter:	**Mapping Type**
Default:	End_to_End
Options:	Local | End_to_End | Gateway
Function:	Specifies whether facilities, call user data, and M-bit and Q-bit support terminate locally or are passed end-to-end. X.25 parameters that you configure at the packet and service record level determine which facilities are supported. The last option is to configure X.25 Gateway services. If you set this parameter to Local, IPEX ports can support different packet sizes at each end. You must also configure the Source X.121 Address parameter for an SVC source connection type, and both Source and Destination X.121 Address parameters for a TCP source connection type. If you configure End-to-End mapping, all IPEX ports must have the same packet and window size, because different packet sizes cause M-bit support to malfunction. If you set this parameter to Gateway you use X.25 Gateway services. X.25 terminates at the router interface, but allows you to configure one of three message header types at the TCP application layer.
Instructions:	Choose Gateway.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.16

Parameter: **TCP Circuit Name**

Default: None

Options: The name of this circuit. When you add a TCP circuit, the name is displayed in the Add Circuit window.

Function: Identifies this TCP circuit for mapping purposes.

Instructions: Enter the name of the appropriate TCP circuit. If you do not know this name, return to the main Configuration Manager window and click on the connector you are configuring to reopen the Add Circuit window.

Parameter: **TCP Header Type**

Default: Short

Options: None | Short | Long

Function: Enables the Message Boundary Protocol. This bit marks the boundary of TCP application data that is consistent with Gateway operation.

None means that there is no message header; Message Boundary Protocol is off.

Short means that the message header contains a 2-byte length field.

Long means that the message header contains a 1-byte type, a 1-byte version, and a 2-byte length field.

Instructions: Choose a header type.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.22

Configuring Mapping Parameters

Complete the following steps to configure IPEX mapping parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the IPEX Mapping Add window, click on **OK**.	The IPEX Mapping Parameters window opens. Depending on your Source Connection Type, Figure 2-2, Figure 2-3, or Figure 2-4 opens.
2. Configure the parameters appropriate to your connection type. Click on **Help** or see the parameter descriptions beginning on page 2-9. Parameters include: • **Source PVC LCN** • **X.121 Called Address** • **Remote IP Address** • **Remote TCP Port Number** • **Local TCP Port** • **Destination Connection Type** • **Destination PVC LCN**	
3. Click on **OK.**	The IPEX Mapping Table Configuration window reopens.
4. Click on **Done**.	The X.25 Gateway configuration is complete. You return to the X.25 Service Configuration window.
5. To learn how to replicate this configuration for other PVC/TCP connections, see the later section of the guide, "Replicating a Configuration." Otherwise, click on **Done**.	You return to the main Configuration Manager window.

IPEX Mapping Parameters Windows

In the appropriate IPEX Mapping Parameters window, define a new mapping entry by specifying source and destination addresses, the format of which depend on whether the connection type is PVC, SVC, or TCP.

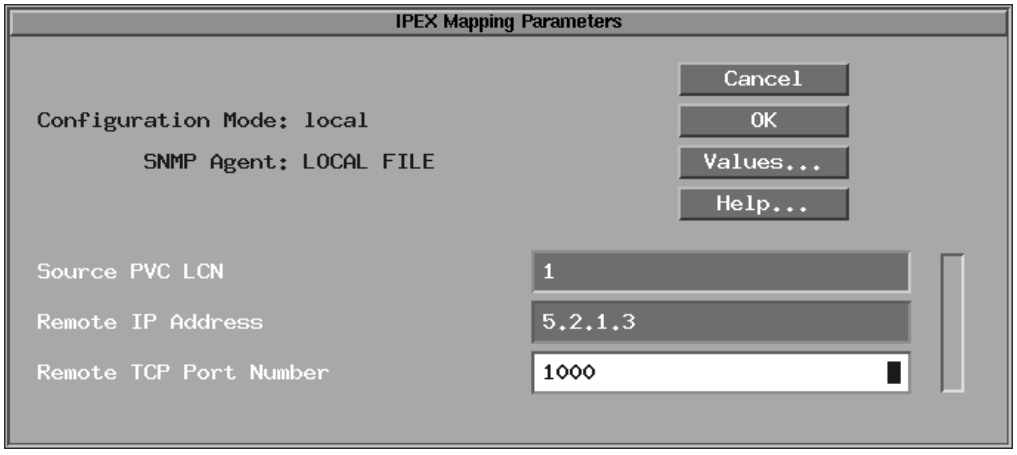

Figure 2-2. IPEX Mapping Parameters Window for PVC

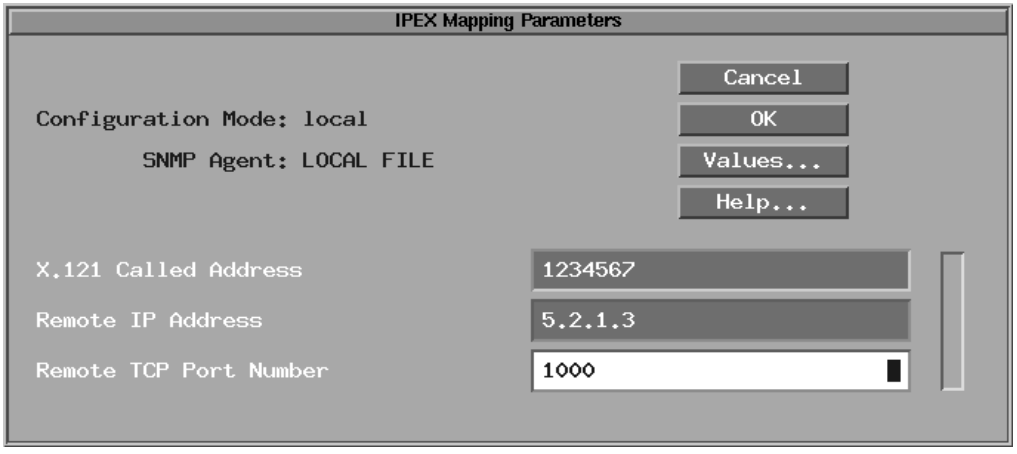

Figure 2-3. IPEX Mapping Parameters Window for SVC

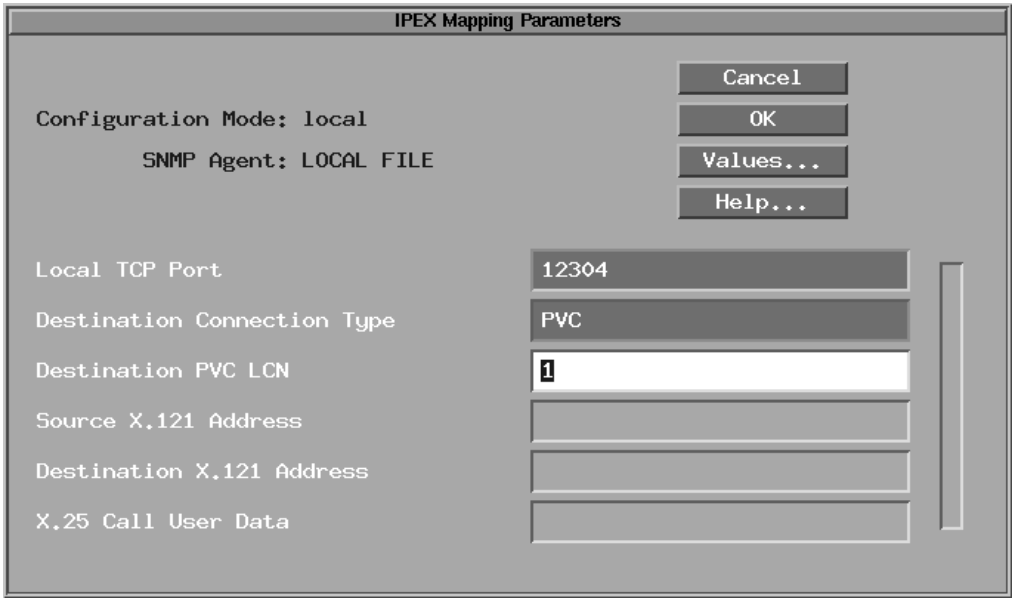

Figure 2-4. IPEX Mapping Parameters Window for TCP

Parameters for PVC and SVC Connections

Parameter descriptions for PVC and SVC connections follow:

Parameter:	**Source PVC LCN**
Default:	None
Options:	1 to 4095
Function:	Specifies the inbound PVC LCN that you map to the TCP connection. The port monitors the X.25 calls for this LCN to initiate the connection.
Instructions:	This window appears only if you chose PVC as your source connection type. Enter the LCN of the PVC for this IPEX connection.
MIB Object ID:	Not applicable

Parameter:	**X.121 Called Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the inbound X.121 called address that you map to the TCP connection. The port monitors the X.25 calls for this X.121 called address to initiate the connection.
Instructions:	This window appears only if you chose SVC as your source connection type. Enter the called X.121 address (up to 15 decimal digits). The destination address depends on the network device to which this circuit is connected. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.6

Parameter:	**Remote IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the remote IP address used to establish a TCP connection to the destination. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the IP address of the remote connection. Use dotted-decimal notation (for example, 1.1.1.1). Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.12

Parameter:	**Remote TCP Port Number**
Default:	None
Options:	The TCP port number at the remote connection, a value between 12304 and 16399.
Function:	Specifies the remote TCP port number used to establish a TCP connection to the destination. The remote TCP port originates connections to the local TCP port. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the TCP port number for the remote connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.13

Parameters for TCP Connections

Parameter descriptions for TCP connections follow:

Parameter:	**Local TCP Port**
Default:	None
Options:	The local TCP port number, a value between 12304 and 16399.
Function:	Specifies the TCP port in the local IPEX connection. This port accepts inbound TCP connections from the remote TCP port. You configure this parameter when the Source Connection Type is TCP.
Instructions:	Enter the TCP port number.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.5

Parameter:	**Destination Connection Type**
Default:	None
Options:	SVC | PVC
Function:	Specifies either SVC or PVC as the destination connection for this TCP source connection.
Instructions:	Choose the value that applies to your network.
	1.3.6.1.4.1.18.3.5.15.2.1.8

Note: Either the source or the destination connection type (but not both) must be TCP.

Parameter:	**Destination PVC LCN**
Default:	None
Options:	1 to 4095
Function:	Specifies the PVC LCN that you map to the TCP connection. The port monitors the X.25 calls for this LCN to initiate the connection.
Instructions:	This window appears only if you chose PVC as your source connection type. Enter the LCN of the PVC for this IPEX connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.11

Replicating a Configuration

After you have configured one PVC-to-TCP or TCP-to-PVC connection, you can copy that configuration and apply it to other connections, rather than configuring the mappings one at a time. If you need to customize some of the connections, you can edit them later.

Note: The Copy function works when one end of a connection is a PVC and the other is TCP. It does not work with SVC connections.

Use the Copy button in the IPEX Mapping Table Configuration window (Figure 2-5) to replicate a configuration. The window is the same for both PVC-to-TCP and TCP-to-PVC connections; the information the window displays varies according to the configuration.

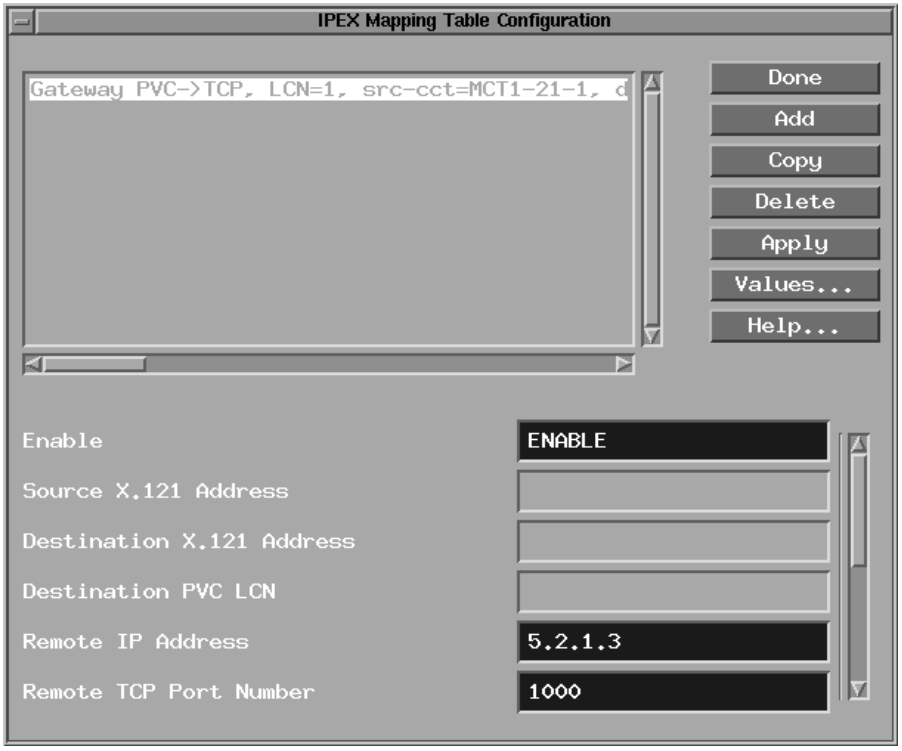

Figure 2-5. IPEX Mapping Table Configuration Window

To replicate a PVC-to-TCP or TCP-to-PVC configuration, complete the tasks in the following table.

Site Manager Procedure	
You do this	**System responds**
1. Choose the configuration you want to replicate, and click on **Copy**.	The IPEX Mapping Replication window opens (Figure 2-6).
2. Set the following parameters. Click on **Help** or see the parameter descriptions beginning on page 2-18: • **Number of instances** • **First LCN number** • **First TCP port number** • **TCP port number increment**	
3. Click on **OK**.	The IPEX Mapping Table Configuration window reopens (Figure 2-7 for PVC-to-TCP, Figure 2-8 for TCP-to-PVC). It now lists all of the connections you have configured with the Copy button.
4. Click on **Done**.	You return to the X.25 Service Configuration window.
5. Click on **Done**.	You return to the main Configuration Manager window.

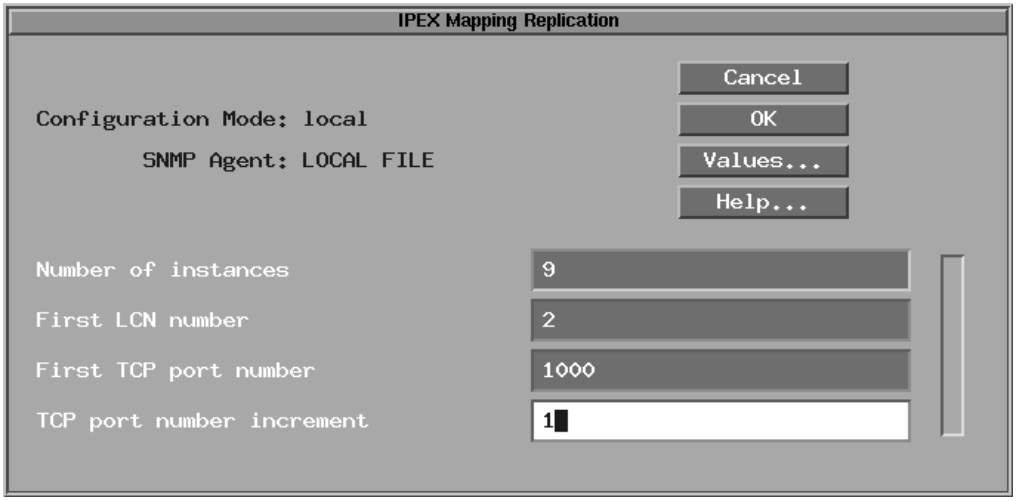

Figure 2-6. IPEX Mapping Replication Window

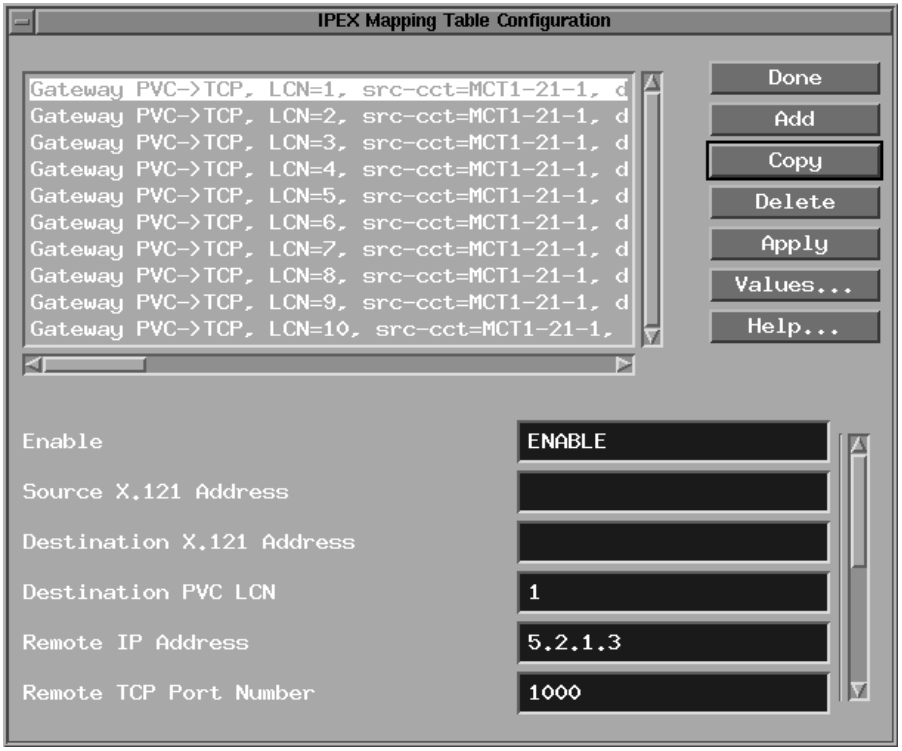

Figure 2-7. IPEX Mapping Table Configuration Window After Replicating a PVC-to-TCP Connection

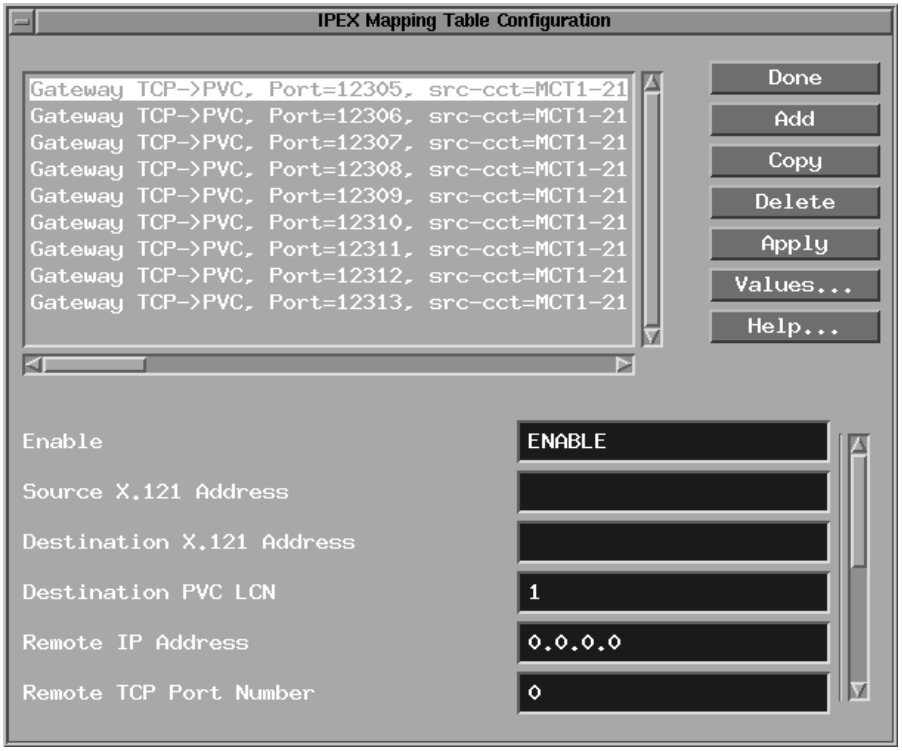

Figure 2-8. IPEX Mapping Table Configuration Window After Replicating a TCP-to-PVC Connection

Parameters for Replicating Connections

Parameter:	**Number of Instances**
Default:	None
Options:	1 to 9 for a FRE2-040-32MB platform 1 to 31 for a FRE2-060-64MB platform
Function:	Specifies the number of connections to be replicated. The maximum number of VCs per channel for the FRE2-040-32MB platform is 10, so you can make up to 9 replicates; for the FRE1-060-64MB platform, the maximum is 32, so you can make up to 31 replicates.
Instructions:	Enter the number of PVC-to-TCP or TCP-to-PVC replicate connections you want to configure.
MIB Object ID:	Not applicable

Parameter:	**First LCN number**
Default:	None
Options:	2 to 10 for a FRE2-040-32MB platform 2 to 32 for a FRE2-060-64MB platform
Function:	Identifies the LCN number of the first PVC that will use the replicate configuration. Each LCN number on a channel must be unique. The options given above assume that you have assigned an LCN number of 1 for the PVC that you are using as the source for replicates.
Instructions:	Enter the LCN number.
MIB Object ID:	Not applicable

Parameter:	**First TCP port number**
Default:	None
Options:	For a PVC-to-TCP connection, this value can be any valid port number. For a TCP-to-PVC connection, this value must be within the range of TCP ports reserved for Gateway service, 12,304 to 16,399.
Function:	Identifies the number of the first TCP port that will use the replicate configuration.
Instructions:	Enter the first TCP port number.
MIB Object ID:	Not applicable

Parameter:	**TCP port increment**
Default:	None
Options:	Any integer. You can assign all of your replicates to the same port, in which case you enter 0 for this parameter, or you can assign each its own port by adding a value to each succeeding port number. In the example given in Figure 2-6, each succeeding port is incremented by a value of 1.
Function:	Instructs the router how to increment port numbers assigned to each of the replicate configurations.
Instructions:	Enter a value.
MIB Object ID:	Not applicable

Index

A

acronyms, xi
adding an IPEX mapping entry, 2-2
address, called X.121, 1-6

B

block, message, 1-13
boundary, message, 1-12

C

called X.121 address, 1-3, 1-6
  SVC with, 1-6
  SVC without, 1-7
channel, 1-7
circuits, interface, 1-6
configuration file
  preparing, 2-1
  replicating, 2-12
Configuration Manager, 1-1
configuring IPEX mapping parameters, 2-7
congestion, 1-3, 1-5
connection
  automatic reestablishment after a fault occurs, 1-8
  from a LAPB terminal, 1-8
  from a TCP/IP terminal, 1-9
  from an X.25 terminal, 1-6
  LAPB-to-TCP, 1-8
  summary, 1-11
conventions, text, x
copying a configuration, 2-12

D

DCE interface, 1-7
destination circuit, definition of, 1-4
Destination Connection Type parameter, 2-12
Destination PVC LCN parameter, 2-12
DTE interface, 1-7

E

educational services, xii
Ethernet, 1-1

F

fault, physical layer, 1-8
FDDI, 1-1
flow control, 1-3

G

Gateway, definition of, 1-1

H

header, message, 1-13

I

interface
  circuit, 1-6
  DCE, 1-7
  DTE, 1-7
  TCP, 1-4

IP (Internet Protocol)
address, 1-4
protocol, 1-3
IPEX
adding a mapping entry, 2-2
mapping parameters, configuring, 2-7
requirement to configure, 2-1
IPEX Mapping Add window, 2-4
IPEX Mapping Parameters window
PVC, 2-8
SVC, 2-8
TCP, 2-9
IPEX Mapping Replication Window, 2-15
IPEX Mapping Table Configuration Window, 2-13
IPEX Mapping Table Configuration Window After Replication
PVC-to-TCP Connection, 2-16
TCP-to-PVC Connection, 2-17

L

LAN media, 1-1
LAPB (Link Access Procedure Balanced)
connection to TCP, 1-8
description of, 1-2, 1-3
point-to-point connection, 1-1
protocol, 1-3
large data message, 1-12
LCN (logical channel number), 1-7
Level 3 Packet Layer Protocol, 1-3
Local TCP Port parameter, 2-11

M

MAN (metropolitan area network) media, 1-1
mapping, 1-8, 1-10
Mapping Type parameter, 2-5
Maximum Transmission Unit (MTU), 1-12
MCT1 (Multichannel T1) interface, 1-1
message
block, 1-13
boundary, 1-12
header, 1-13
large, 1-12
message-based protocol, 1-12
MTU (Maximum Transmission Unit), 1-12

N

network
X.25, 1-1
network topology
TCP/IP-to-LAPB, 1-2
TCP/IP-to-X.25, 1-2

P

Packet Layer Protocol *See* PLP
parameters, IPEX
Destination Connection Type, 2-12
Destination PVC LCN, 2-12
Local TCP Port, 2-11
Mapping Type, 2-5
Remote IP Address, 2-10
Remote TCP Port Number, 2-11
Source Connection Type, 2-4
Source PVC LCN, 2-9
TCP Circuit Name, 2-6
TCP Header Type, 2-6
X.121 Called Address, 2-10
permanent virtual circuit. *See* PVC
PLP (Packet Layer Protocol), 1-3
point-to-point connection, 1-1
port, TCP, 1-4, 2-11
product support, xii
protocol
IP, 1-3
message-based (X.25), 1-12
TCP, 1-3
TCP stack, 1-11
unstructured stream (TCP), 1-12
X.25 Level 2, 1-3
X.25 Level 3, 1-3
X.25 stack, 1-11

publications, Bay Networks, xii
PVC
configuring for X.25 Gateway, 1-3
definition of, 1-1
description of Gateway connection, 1-7

R

Remote IP Address parameter, 2-10
Remote TCP Port Number parameter, 2-11
replicating a configuration, 2-12

S

socket, 1-6, 1-7, 1-8
source circuit, definition of, 1-4
Source Connection Type parameter, 2-4
Source PVC LCN parameter, 2-9
stream protocol (TCP), 1-12
support, Bay Networks, xii
SVC
configuring for X.25 Gateway, 1-3
definition of, 1-1
description of Gateway connection, 1-6
with called X.121 called address, 1-6
without called X.121 address, 1-7

T

T1 interface, 1-1
TCP
description of Gateway connection, 1-10
large data message, 1-12
port number, 2-11
protocol stack, 1-11
socket, 1-6, 1-7
unstructured stream protocol, 1-12
TCP (Transmission Control Protocol)
interface, 1-4
port number, 1-4
TCP Circuit Name parameter, 2-6
TCP Header Type parameter, 2-6
TCP/IP-to-X.25 gateway, 1-2
technical publications, xii
technical support, xii
terminal, X.25, establishing connections from, 1-6
text conventions, x
token ring, 1-1
translation stream, 1-8
establishing (TCP initiated), 1-10
establishing (X.25 initiated), 1-5
X.25-to-TCP, 1-11
Transmission Control Protocol *See* TCP
transmission unit, maximum, 1-12

W

windows
IPEX Mapping Add, 2-4
IPEX Mapping Parameters
PVC, 2-8
SVC, 2-8
TCP, 2-9
IPEX Mapping Replication, 2-15
IPEX Mapping Table Configuration, 2-13
IPEX Mapping Table Configuration After Duplication
TCP-to-PVC Connection, 2-17
IPEX Mapping Table Configuration After Replication
PVC-to-TCP Connection, 2-16

X

X.121 called address, 1-3, 1-6, 1-7
X.121 Called Address parameter, 2-10
X.25
Gateway, definition of, 1-1
large data message, 1-12
Level 2 (LAPB-only) interface, 1-1, 1-3
Level 3 (PLP) interface, 1-1, 1-3
message-based protocol, 1-12
networks, 1-1
protocol stack, 1-11
PVC, 1-1
SVC, 1-1
VC, 1-1